PATENT SPECIFICATION

DRAWINGS ATTACHED

915,231

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COMPLETE SPECIFICATION

Improved Hydraulic Motor

We, ATELIERS DE POCLAIN-BATAILLE et Fils, a French Body Corporate, of Le Plessis-Belleville (Oise) France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to an hydraulic motor of the piston type, the cylinder of which are arranged in a cylinder-block and are supplied through a distributor having a plane valve face which is fixed with respect to the engine frame.

Devices are of course known which are constructed according to this principle and in which the admission and exhaust orifices of the distributor begin to be unmasked and enter into communication with conduits which supply the cylinders after the pistons have moved to top dead-centre and bottom dead-centre.

This type of device has the additional property of a particularly simple reversal of operation: it is in fact sufficient to transpose the intake and outlet of fluid on the upstream side of the distributor.

The present invention accordingly provides an hydraulic motor of the piston type, comprising a rotating cylinder block defining a plurality of main cylinders therein, a piping system supplying said main cylinders and comprising one supply pipe for each main cylinder, a distributor adaptor to supply pressure fluid to said piping system and a speed changing device comprising shutting-off means for shutting-off predetermined numbers of said supply pipes so that fluid is supplied to predetermined numbers of main cylinders, the arrangement being such that said speed-changing device determines at least three discrete motor speeds.

In the form of embodiment which is described below, the shutting-off means comprise small pistons, the movement of which is produced by the action of a pressure of fluid on one of the faces of each piston, the fluid being taken from a by-pass on the supply to one of the cylinders.

In the accompanying drawings, a form of embodiment of the present invention has been illustrated by way of example only and not in any sense by way of implied limitation, in which:—

Fig. 1 is a general cross-section through the axis of the engine taken along the line I—I of Fig. 2.

Fig. 2 is a transverse cross-section taken along the axis II—II of Fig. 1 (it can be noted at this point that the pipe 2c located the bottom portion of the main cylinder 2b1 has been purposely deformed so as to make the drawings more easily understood, as will be clearly explained in the description).

Fig. 3 is a transverse cross-section of the cylinder-block taken along the line III—III of Fig. 1.

Fig. 4 illustrates a cross-section of the cylinder-block, limited to the axis of this latter and taken in any of the directions IV, IV^{1} and IV^{11} of Fig. 3.

Fig. 5 illustrates a cross-section of the cylinder-block, limited to the axis of this latter and taken in any one of the directions V and V^{1} of Fig. 3.

Figure 6 illustrates a cross-section of the cyinder-block, limited to the axis of this latter and taken in the direction VI of Fig. 3.

Fig. 7 is a transverse cross-section of the distributor taken along the line VII—VII of Fig. 1.

Fig. 8 is an axial cross-section of the distributor taken along the line VIII—VIII of Fig. 7.

For the sake of clarity of the description, the speed-changing device forming the object of the present invention will be described after

a short summary relating to this type of engine and its method of operation.

The engine is essentially constituted by a frame 1, in the interior of which rotates a cylinder-block 2. Seven radial pistons 3 supplied through a distributor 4 are disposed in the said cylinder-block. The rotation of the cylinder-block, which is coupled to the output shaft 5 of the engine, is obtained by means of moving systems mounted on the piston-heads and effecting a rolling movement on a cam 6 which is fixed to the engine frame and comprises eight corrugations 6a.

The moving systems referred to above are constituted by two ball-bearings 7 fitted on to a shaft 8 which is acted upon by the piston-head.

The engine additionally comprises a number of other particular features which are made apparent by the description which follows below.

The engine frame is provided on its right hand side (as shown in Fig. 1) with a fluid inlet 1a and a fluid outlet 1b which open into the interior of two channels 1c and 1d constituting the admission and evacuation chambers of the distributor 4, which is fixed to the engine frame by means of studs 9. Toric joints 10 ensure fluid-tightness between the two chambers 1c and 1d. The distributor is essentially constituted by a series of eight circular orifices 4a which open into the chamber 1c, are spaced apart at regular intervals and regularly alternated with eight other circular orifices 4b which open into the chamber 1d (as shown in Fig. 7).

An opening 1e in the casing of the engine frame has the function of an overflow and is connected to the tank containing the fluid which has already circulated in the engine.

The orifices 4a and 4b referred to above are successively put into communication through the admission pipes 2a with each of the seven main cylinders 2b of the cylinder-block. Furthermore, the arrangement of the said orifices is so designed that when the pistons 3 are at top dead-centre and at bottom dead-centre, there is neither any admission nor any evacuation of fluid.

When the main cylinders 2b are supplied with fluid, the pistons are displaced, thereby starting the rotation of the cylinder-block and thus driving the engine shaft. It should be noted that, for each revolution of the engine, the pistons will carry out a certain number of movements of travel equal to the number of corrugations of the roller-track cam, while the combination of eight corrugations and seven pistons additionally ensures perfectly smooth starting.

When the cylinders are no longer supplied, in particular as a result of the action of changing speed, the operation of which will be described below, an elastic strip 11 restores the pistons to bottom dead-centre.

As has been stated above, the speed-changing device which constitutes the object of the present invention works by effecting the variation of the cylinder capacity of the engine.

The said device is essentially composed of the following members: a distributor 12 mounted co-axially with the cylinder-block 2 is operated by means of a rod 13 on which is mounted a roller-bearing 14 which permits the rotation of the distributor. The said distributor 12 puts the main cylinder 2b1 and the small secondary cylinders 2d into communication as shown in Fig. 1 and 2, through a pipe 2c which is provided with a non-return valve 15. The displacement of the pistons 16, the lift of which is limited by a lug 17 forming a stop, takes place in the said small secondary cylinders.

The distributor 12 referred to above is provided with a number of circular grooves 12a in any one of which may be housed a ball 18 applied by a spring 19. This device provides a means of maintaining the distributor 12 in a fixed position with respect to the cylinder-block 2, at least in the axial direction.

With each of the main cylinders 2b2, 2b3, etc. there is associated one of the secondary cylinders 2d2, 2d3, etc. However, the cylinder 2b1, which serves as an intermediate fluid-tank for the operation of the speed-changing device, is not associated with any of the cylinders 2d for the reasons which will be made apparent in the following paragraphs.

In order to describe the operation of the speed-changing device, we shall first assume that the distributor 12 has been moved to the left hand end of the housing 2e. In this position, the extremity 12b of the distributor unmasks the supply orifices 2f of the secondary cylinders 2d which are then in communication with the casing. There is consequently only a low pressure in the cylinders 2d and the pistons 16 are held in their position of rest by an elastic strip 20. Under these conditions, all the main cylinders 2b are supplied as has been described in the first section, and the operation of the pistons 3 ensures the normal rotation of the engine.

If the control-rod 13 is drawn in the direction of the arrow A, the extremity 12b of the distributor is held by virtue of the ball 18 which is brought into one of the grooves 12a, in a position such that the supply orifices 2f4, 2f5, 2f7, are again in communication with the casing while the orifices 2f2, 2f3, 2f6, of the corresponding secondary cylinders 2d, as shown in Fig. 4, put the said cylinders into communication with the annular space 21, which is supplied with fluid through the pipe 2c. The pistons 16 of the secondary cylinders 2d2, 2d3, 2d6 are then lifted and shut-off the admission pipes 2a while uncovering by means of a port 16a, the evacua-

tion orifices 2g2, 2g3, 2g6 of the main cylinders 2b2, 2b3, 2b6 which can thus be emptied into the casing. The pistons located in those main cylinders 2b which are no longer supplied with fluid are then brought back to bottom dead-centre by the elastic strip 11. This arrangement prevents the corresponding moving systems from knocking against the cam 6.

If the control-rod 13 is again pulled to cause engagement of ball 18 in succeeding grooves 12a, additional main cylinders 2b will be put out of circuit, so that the cylinder capacity of the engine is correspondingly reduced.

In the form of embodiment which has been described, four speeds corresponding to the operation on 7, 4, 2 and 1 cylinders are made available for a given rate of flow of fluid. In fact, the three cylinders 2b2, 2b3, 2b6 shown in Fig. 4, followed by the two cylinders 2b5 and 2b7 shown in Fig. 5, then the cylinder 2b4 shown in Fig. 6, are successively put out of circuit. It is obvious that the number and position of the cylinders 2b which are put out of circuit depends solely on the orientation of the supply orifices 2f and on the number of grooves 12a in the distributor 12. These two parameters can be fixed according to the designed speeds of operation of the engine.

WHAT WE CLAIM IS:—

1. An hydraulic motor of the piston type, comprising a rotating cylinder block defining a plurality of main cylinders therein, a piping system supplying said main cylinders and comrising one supply pipe for each main cylinder, a distributor adapted to supply pressure fluid to said piping system and a speed changing device comprising shutting-off means for shutting-off predetermined numbers of said supply pipes so that fluid is supplied to predetermined numbers of main cylinders, the arrangement being such that said speed changing device determines at least three discrete motor speeds.

2. An hydraulic motor as claimd in Claim 1, in which said shutting-off means comprises a secondary cylinder associated with each main cylinder, a piston slidably supported in each said secondary cylinder, and in which the supply pipe of each main cylinder opens into the associated secondary cylinder.

3. An hydraulic motor as claimed in Claim 1 or 2 comprising means for selectively actuating said shutting-off means constituted by means for supplying pressure fluid to displace said shutting-off means to close the supply pipes of the selected main cylinders, and elastic means acting on said shutting-off means to open said supply pipes of the other main cylinders.

4. An hydraulic motor as claimed in Claim 3, wherein said speed changing device comprises a second piping system connected as a by-pass on the supply pipe of one of said main cylinders, the pressure fluid which operates the shutting-off means being delivered by said second piping system.

5. An hydraulic motor as claimed in Claim 4, wherein said means for supplying the pressure fluid which operates the shutting-off means comprises a distributor mounted coaxially with said cylinder block and having an annular groove to provide hydraulic communication between said by-pass of said main cylinder and said shutting-off means.

6. An hydraulic motor substantially as herein described with reference to the accompanying drawings.

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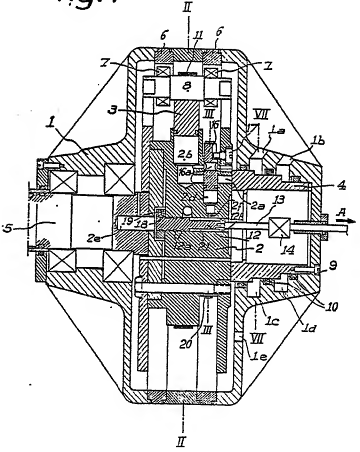
Fig. 1


II
6
11
6
7
7
8
3
III
VII
1
16
17
1a
1b
2b
16a
4
2a
13
A
5
19
18
2e
12
2
14
9
10
1c
1d
III
VII
20
1e
II

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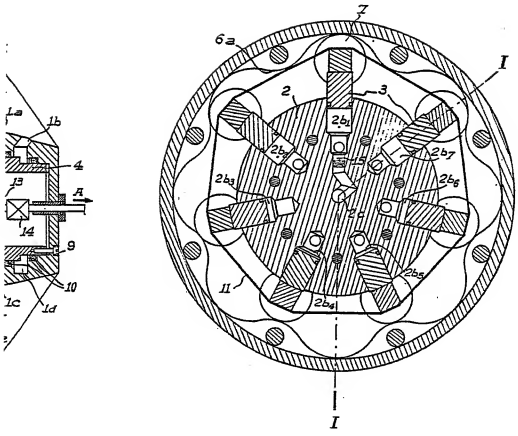
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 1 & 2

Fig. 2



915231 COMPLETE SPECIFICATION
3 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheets 1 & 2

Fig. 1

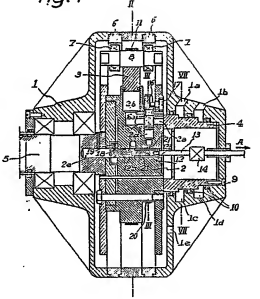


Fig. 2

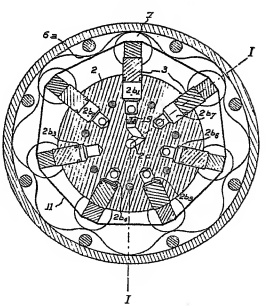


Fig. 3

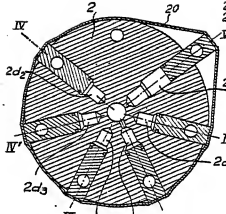
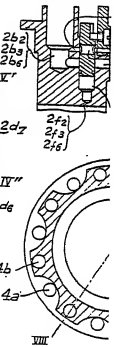

2
20
IV
IV'
IV''
V'
V
VI
VIII
2d2
2d3
2d4
2d5
2d6
2d7

Fig. 4


2b2
2b3
2b6
2f2
2f3
2f6
4b
4a

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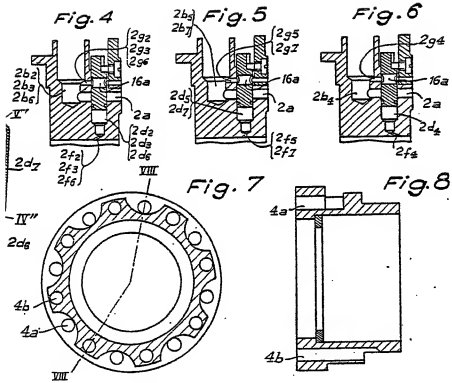
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 3



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3 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 3